

LABELING ILLUSTRATIONS

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Sometimes really good illustrations are spoiled by faulty or poorly made labels and not infrequently biological illustrators do not do sufficient labeling to make their illustrations clear. The thought is frequently expressed by good draughtsmen that labeling is difficult and is therefore to be avoided, or they say they wish that they had been born with the ability to letter drawings properly thus expressing clearly that in their own opinions their drawings are not labeled as they should be. With these thoughts in mind it seems not amiss to outline the following methods that may be used for labeling biological illustrations.

It frequently becomes necessary to indicate separate parts on an illustration, hence it becomes necessary to label the drawing. This may be done in a variety of ways. If the person making the illustration has enough ability he may make the lettering free handed. Another method is to select letters or figures from printed matter. These may then be cut out and pasted on the illustration in the proper place. Still another method is to buy the cut-out letters and figures and paste these on the illustration. The sets desired may be written on the typewriter and cut out and pasted on the illustration. Labels may be printed directly on the illustration. And lastly guide lines may be drawn to the margins of the illustrations where they may be connected with type set up in the ordinary way when the illustration is printed. Regardless of the method of labeling selected care should be exercised to make the labels as neatly and accurately as possible. Care should also be exercised to see that the lettering is sufficiently large to stand the necessary reduction if the illustration is reduced.

The labels of biological illustrations are generally indicated in the following manner: (1) by Arabic numerals, (2) by the initial letters of the name of the parts of the object labeled, (3) by abbreviation of the names of the parts of the object labeled, (4) by a sequence of letters, and (5) by the full names of the parts of the object. In the first four methods it is necessary to print an explanation of the

labels. The fifth method requires no explanation. The method selected will depend upon the personal choice of the draughtsman. There is much to be said in favor of the fifth method provided there are not too many parts to label or the names are not too complicated. By this method the attention is not distracted by having to search through a long list of explanations. If it is preferred to abbreviate the names, then there is much to be said in favor of the second and third methods, for the initial letters and the abbreviation will indicate the real name of the part. If either of these methods is selected the explanations should be arranged alphabetically, so that it will not be necessary to look through the entire list to find the explanation for any abbreviation.

The labels may be placed at the margin of the illustration or directly on the illustration. The method we select will depend to a great extent on the nature of the illustration. If the parts are large enough so that the labels may be placed directly on the part without obscuring any details this is perhaps the best method. For many illustrations, however, this is not possible. The labels should then be placed at the margin. This latter method necessitates the use of guide lines. Guide lines may be simple straight lines or they may be brackets. Brackets are used to indicate areas of considerable extent which could not be indicated by a single line. Instead of the bracket, two lines drawn at an angle to each other may be used. The straight lines may be solid, dotted or dashed lines. If a dashed or dotted line is used care should be taken to get the dots of uniform size or the dashes of uniform length. As a general proposition guide lines should be straight and should run parallel to the main margin of the drawing if possible. On very light drawings the guide lines should be black. If the guide lines run over alternate dark and light areas it is advisable to use a double line, one part being black and the other part white. Care should be exercised to keep guide lines of uniform thickness. This may readily be accomplished by using a ruling pen. Ordinary liquid India ink may be used for black lines and any good grade of Chinese white for white lines. Care should be taken not to make the lines so thick that they will look unsightly when the drawing is complete. On the other hand, the lines should not be so delicate that they will not stand the necessary reductions.

Cut out letters or figures which are gummed on the back may be purchased in a wide variety of styles and sizes. These are very desirable for labeling drawings especially if the correct size and a suitable style are selected. Care should be taken to see that the separate letters are pasted in a straight line. This may readily be accomplished by drawing a faint pencil line to indicate the bottom of the letters, and then bringing the letters to this line. Cut out letters have the advantage that they may be pasted directly on the illustration, and will obscure only a minimum amount of detail.

Labels may be written on the typewriter using a good black record ribbon. In making labels on the typewriter only a new ribbon should be used and the type should be thoroughly clean so that good sharp impressions can be secured. These labels may then be cut out and pasted on the drawing as recommended above for printed labels. The chief difficulty with this method is that the labels are too small unless the illustration is not to be much reduced in reproduction. Type written labels may be enlarged by making a negative from them by any of the enlarging methods, and then printing a positive from this negative on a smooth gaslight paper. This method is advocated chiefly where we need a large number of labels of the same kind.

Labels may be selected from printed matter and pasted on the drawing. It is necessary to bear in mind the amount of reductions that will take place in reproducing the drawing. The ordinary book type is about 9 points, therefore if the drawing is reduced to one third the original labels should be 28 point. If the drawing is reduced to one fourth the original label will have to be 36 point. It is usually difficult to find letters of sufficient variety in these sizes. Special labels may be set up by the printer but this is usually a very expensive method. Plate XIV shows the various sizes of printed letters and may be used to determine the size of letters that it is necessary to use. Thus if the drawing is reduced to one third labels the size of 36 point will appear as 12 point or 18 point will appear as 6 point, etc. The various sized letters on this plate may be traced on thin tracing paper in India ink and pasted on the drawing.

HAND PRINTED LABELS FROM RUBBER TYPE

Labels may also be printed by hand from rubber type directly on the illustrations. For printing labels from rubber type we will

need a set of rubber type of the proper size, holder to hold the type, and a stamp pad filled with faint blue ink. The proper combinations of letters are set up in the holder, bearing in mind that the type are inverted and reversed. The type in the holder are then stamped in the pad and then on the drawing. The labels are then traced over with India ink. It is necessary to trace over labels made with a rubber stamp because the margins are not clear cut. The advantage of using the pale blue ink is that if the illustration is reproduced by ordinary photographic processes the blue will not show and need cause no trouble if slight errors are made. Rubber type may be secured in a variety of styles and sizes. A neat legible style should be selected and a size selected so that it will stand the necessary reduction. Sets of complete alphabets may be purchased or separate stamps may be produced from dealers in office supplies. The former has the advantage that any label may be readily set up. The latter is preferable if many labels of the same kind are to be printed at one time. The holders for rubber type are usually supplied with the sets of type. These holders are convenient and since they are adapted to the size type with which they are supplied they leave little to be desired. Stamp pads for this purpose should be inked with a faint blue ink as this color is not very active, photographically it does not bother the engraver. After the labels have been stamped with the faint blue ink they must be finished up with black India ink. This requires a fine pen and a little attention to details, but can be done with considerable rapidity after a little practice.

HAND PRINTED LABELS FROM METAL TYPE

Labels may also be printed from the regular metal type of the printer very much as the rubber type is used. To print labels from metal type we will need some black printers ink, a font of type of proper size, a holder for the type and a compositor's roll.

The ink used for hand printed labels of the metal type is the regular black printers ink. This usually requires thinning to work properly. Benzine, gasoline or xylol may be used for thinning the ink. For this purpose the ink is placed on a piece of glass and the solvent is added drop by drop while the ink is worked with a spatula, until it is of the proper consistency. Experience soon teaches when the ink is of the proper consistency. When it is thought that the ink is properly mixed a small amount of the prepared ink is spread on the

compositor's roll and the type in the holder is stamped on the roll and printed on a piece of paper. If the ink is in the proper condition and has been properly spread on the roll enough will adhere to the face of the type to make a good label. If the ink is too thin it will spread when we attempt to print a label. If it is too thick not enough of it will adhere to the face of the type to print a good label.

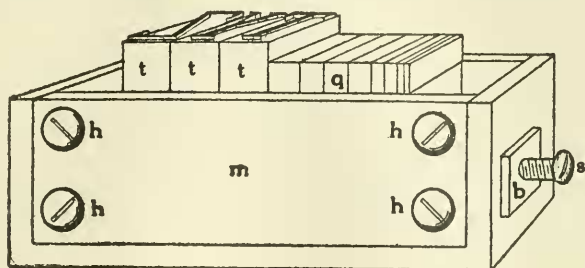


Fig. 1. Type holder for printing labels.

b, bur of the stove bolt which is soldered to the type box.

h, heads of stove bolts used to clamp the movable plate against the type

m, movable plate

q, quads which are used to fill out the line of type

s, stove bolt used to clamp the type in the line

t, type

The type holder (Fig. 1) used for hand printed labels is a shallow box made of brass. The height of the box is a little less than the height of the type. One side of the box is movable and is fastened to the opposite side by means of four set screws. This is used to lock the type in rows. One end of the box has a set screw which is used to lock the type. This holder is used very much as an ordinary rubber stamp is used. If only one figure or letter is to be printed in each label it is not necessary to use the type holder, but the individual types can be held in the hand very readily.

Type is set up in an inverted and reversed position. Each piece of type has little grooves called the nicks which indicate when the type is in a proper position. As soon as a line of type is set up a glance will reveal whether all of the characters are in the proper position. The characters to be used are picked out from the type box one at a time and placed in the holder which is held in the left hand in an inclined position so that the type will lay against the fixed side of the holder. As soon as the label is completely set up the rows of type are locked in place by tightening the set screws

which fasten the movable side and the end. At first the set screws are only set tight enough to hold the type firmly in place. A soft wooden block is then placed on the face of the type and the type is leveled up by pounding with a light hammer. The properly set up label is firmly pressed on to the inked compositor's roll and the inked type is then stamped on the illustration. Care being taken to press the type down firmly at all points without allowing it to move.

The advantages of hand printed labels are that they are very neat and accurate and that they may be made by any one without previous experience. The chief disadvantage is that it is somewhat laborious to set up the type. But with the large sized type used in printing labels for illustrations this is not a very large item. It must be remembered that it requires several hours for the printers ink to dry and care must be exercised in handling the illustrations or the labels may be ruined.

FREE-HAND LETTERING

Occasionally it is not possible to letter an illustration by any of the methods given above, in that case it is necessary to have recourse to free-hand lettering. Free-hand lettering is a special kind of free-hand drawing by means of which the draughtsman learns to draw the design of letters neatly and rapidly. There are no special tricks of the trade about lettering that cannot be learned by the biologist who will conscientiously try to master the subject.

The first consideration in free-hand lettering as in other kinds of free-hand drawing is to get the main proportions. After the main proportions are secured the details are added. The more important details are added first then the finer and finer details until the lettering is complete. Just as the individual letters are found to vary one from the other so in printing a line of lettering it will be found necessary to space the letters carefully with reference to each other, otherwise the lettering will not have a neat appearance when finished. In lettering each letter is influenced by the letters on each side of it so that no general rule can be laid down which will make it possible to always place a letter the proper distance from its neighbors. The only rule that can be given is that all letters should seem to have the same amount of space allotted to them. Obviously this amount of space will vary with the different letters and with the letters on each side of it. Thus a capital I requires less space than a capital M.

Then, too, a capital I will require more space if placed between a capital M and a capital N than if placed between a capital E and a capital T because these letters have a great amount of free space whereas the M and N have practically no free space. The letters in each word must be studied, therefore, in order to determine the proper spacing. Trials should be made in order to see just what spacing looks the best. If this is done critically gradually a proper conception of proper spacing of letters will be acquired.

The usual error made by beginners is to space the letters too far apart. Letters look better when they are crowded well together.

The letters in any design that is to be treated in free-hand lettering should be sketched in with a pencil complete before finishing up any of the letters. This is done in order to insure a proper balance of the words with each other and a proper spacing of the letters. In sketching letters it is usually advisable to draw two faint lines one for the top and the other for the bottom of the letters. Sometimes it is advisable to divide this space by a third line so that certain letters may be carefully drawn with rapidity. After the base lines are drawn the letters are sketched in spacing each letter with reference to the other letters, and indicating at first only the general outlines of the letters. Corrections should be made until the whole has a well balanced appearance. Some letters may then be carried forward and the principal minor details indicated, making any necessary corrections in the other letters in the line to maintain the balance. After experience has been gained letters may be sketched in ink free-hand, especially such forms as the Gothic. And any one having considerable lettering to do should practice this form of lettering, but the art of lettering is soon lost unless it is used day by day.

After the pencil sketch of a line of lettering is finished the letters may be finished with India ink on drawings or with black water color or oil color on paintings. In doing this the borders of the main letters are finished first and then the borders of the finer details; the body of the letters being filled in last of all. Care must be taken in finishing up the borders not to exceed the limits penciled and to keep all straight lines straight and all curved lines a true curve. In filling in the body of the letter care must be taken not to allow the color to run over the borders that have been finished. In finishing large letters a ruling pen and a straight edge may be used for the longer

straight lines on the borders of the letters but on the smaller letters and for all fine details a pen must be used free hand.

The idea is prevalent that the forms of letters are fixed but nothing is farther from the truth. There are certain broad general styles of letters such as the Roman and Gothic but the variations in these styles are as many as there are draughtsmen. A few of the more important styles are discussed below and plates showing standard letters are given, not with the idea that these should be copied slavishly but that these designs may be helpful in producing letters for drawing and may serve to indicate the main styles. All letters occur in two forms, capitals usually called caps and small letters called lower case. If there are only a few letters in a group as in the abbreviated signs used to label parts of a drawing either caps or lower case or both kinds of letters may be used, but if there is a series of words it is better to use lower case letter throughout as we are used to reading words printed in lower case types. Words in lettering should be well separated so that there is no doubt as to the limits of the separate words. The rule is that the words should be separated at least by a space equal to that occupied by the widest letter and slightly more space would be better.

The Gothic letter is the simplest letter because it is formed of lines of a uniform thickness throughout. Gothic letters exist in two forms, a vertical Gothic and an inclined Gothic. In the vertical Gothic alphabet the main axis of the letters is vertical and since the lines are all of a uniform thickness it is a fairly easy alphabet to letter in a free-hand manner. For convenience of discussion the letters are divided into the following groups, (1) letters composed of straight horizontal and vertical lines, (2) letters composed of horizontal or vertical lines with diagonal lines, (3) letters composed of straight and curved lines and (4) letters composed of curved lines only. Furthermore it is convenient to define a full bodied letter as a letter occupying as much horizontal as vertical space. For purposes of analysis the letters are drawn on cross section paper each letter occupying a vertical distance of five units. The thickness of the stroke is only $2/3$ of a unit.

In the first group of letters we have the capitals E, F, H, I, L and T and the lower case letters i, l. In the capital E it will be noted that the letter is not a full-bodied letter as the foot occupies only $4\frac{1}{2}$ units and the cap only 4 units. The tongue of the letter occupies

only $2\frac{1}{2}$ units and is placed only slightly higher than the middle. The capital F is identical with the E except that the foot is omitted. Care should be taken not to extend the cap too much or the letter will look top-heavy. The capital H occupies about 4 units as otherwise it looks too broad. The tongue is placed on a level with the tongue in the E and F, that is slightly above the middle. The capital I needs no comments as it is simply a straight line with a thickness of $\frac{2}{3}$ of a unit. The foot of the capital L is about $3\frac{1}{2}$ units in length to prolong it makes it appear unwieldy. The full bodied lower case letter occupies only three-fourths the space allotted to the full bodied capitals and the width of stroke is only a half unit. The small lower case letters occupy only two-thirds of the vertical space occupied by the large lower case letters. Therefore the body of a small lower case letter like i would occupy only one-half of the vertical space allotted to a capital letter, hence $2\frac{1}{2}$ units the dot being placed one full unit above the top of the letter. The lower case l would occupy $\frac{3}{4}$ of the vertical space allotted to a capital.

To the second group belong the capitals A, K, M, N, V, W, X, Y and Z, and the lower case letters k, v, w, x, y and z. The capital A occupies the full width of five spaces below and slopes to the top line uniformly on both legs. The top does not end in a sharp point but in a point that is about one-half unit wide. The tongue of the A is placed about one and one-half units above the base line. The capital K is somewhat difficult as it is composed of two diagonal lines at different angles. The top diagonal is usually placed about three and one-half spaces from the vertical stroke and at such an angle that if it were projected the lower border of the diagonal would strike the base line one full unit to the left of the vertical stroke. The lower diagonal is placed four units from the vertical stroke and at such an angle that its top border projected would strike the top of the vertical stroke. The capital V is simply the capital A inverted and the tongue omitted. The capital M is simply the V with two vertical strokes added on each side. Note that these vertical strokes end in their full width and not reduced as in the case of the top of the A and the bottom of the V. The capital N consists of two vertical strokes four units apart connected by a diagonal running from the top of the left hand stroke to the bottom of the right hand stroke not the reverse as is frequently seen in lettered signs. The diagonal is placed at such an angle that the vertical strokes will end in full

width on both the base and top limiting lines. The capital W may be considered as two V's contracted to occupy only four spaces each and united so that the apex of the jointed diagonals shall occupy only half a unit each. The capital X is simply two diagonals which cross each other in the center. This letter is therefore a full bodied letter. The capital Y is composed of two arms which are six units apart and run at such an angle as to unite two and one-half units from the base line. The foot of the capital Z is four and one-half units long and the cap only four units long. The cap and the foot are connected by a diagonal placed at the proper angle. In the lower case letters the stem of the K occupies the full vertical unit for lower case letters and the diagonals of the letter bear the same relation to each other that they do in the capital K but they are reduced to one-half. The lower case v, w, x and z are the same as the caps except they are reduced to one-half. The lower case y is the same as the lower case v with the right diagonal extended below the base line, the full length allotted to lower case letters.

In the third group we have the capitals B, D, J, P, R and U; and the lower case letters a, b, d, e, f, g, h, m, n, p, q, r, t, and u. The capital B may be considered as a capital E with the ends of the cap and the foot connected to the tongue by arcs of circles. It will be noted that this makes the top part of the letter somewhat smaller than the bottom. The capital R may be considered as a capital F with the cap and tongue connected as in the B and a tail added to the lower part. The tail of the R should extend beyond the top part of the letter at least a full unit otherwise the letter will look top-heavy. The P is similar to the R without a tail but the top part of the P is made longer by dropping the tongue about one-half unit below its position in R. A capital D is produced by using a foot and cap similar to the foot and cap in the capital B and connecting these two horizontal lines by a regular curve. The capital J and U are similar to each other save that the J has a single vertical arm and the U a double arm. The J is somewhat narrower occupying only three and one-half units whereas the U occupies about four and one-half units. The vertical arms are in each case about three and one-half units long. In the lower case letters b, d, p and g all have the same form and the q is simply the g with the stem turned to the left to distinguish these two forms; and the a is quite similar but with a shorter stem. The lower case u may be taken as the type of another

group of letters. It is essentially like the capital U with the right arm extended to the base. The lower case n is simply the u turned upside down and reversed and the m is simply two ns contracted slightly and united. While the lower case h is simply the n with the left side prolonged the full length of lower case letters. The lower case f, j, r and t are essentially vertical lines with short curved tails added. The capitals O and Q are essentially complete circles which extend slightly above the top line and slightly below the base line. The capitals C and G are parts of circles and offer no special difficulties. The capital S is composed of two curves joined by a third curve and is one of the most difficult letters to handle. The upper and lower limbs are arcs of ellipses whose major axes lie in horizontal planes with the major axis of the upper ellipse slightly shorter than the major axis of the lower ellipse and with their minor axes about in the ratio of two to three. The lower case o, a and s are essentially the same as the corresponding capitals and lower case c is similar with a horizontal line across the upper two-thirds of the circle.

The Gothic numerals may be taken as standard just as we took the Gothic letters. It will be noted that the numerals 1 and 4 are the only ones composed of straight lines only. The numeral 1 is a straight line $\frac{1}{2}$ unit wide, the numeral 4 has a total width of four units and is drawn so that the horizontal tongue is one and one-half units above the base line. The numerals 3 and 8 are essentially the same being composed of two broad ellipses joined together the upper ellipse having a shorter major axis than the lower ellipse. The minor axes of the two ellipses bear a relation of about 2 to 3 to each other. The numeral 0 is merely a flattened ellipse with a major axis of 5 units and a minor axis of 4 units. The numerals 6 and 9 are the same being simply placed in different positions. It will be noted that they are essentially the same as the numeral 0 except for the formation of the small ellipse at the bottom of the 6 and the top of the 9. Note further that the tail of the 9 is somewhat expanded being near the base line and that the tail of the 6 is somewhat contracted being near the top line. This preserves the proper balance. The numeral 5 is essentially the same as the 6 except that the tail is composed of a straight vertical and horizontal line. The top is somewhat contracted to preserve the proper balance. The numeral 7 is four units wide with the curved vertical stroke ending on the base line about one unit to the right of the point where the horizontal line starts on the

top limiting line. The numeral 2 is the most difficult in the whole series as it consists of a compound curve. The top curve is somewhat like the top curve of 3 but is flatter and the bottom curve is more pronounced than the curve in the numeral 7.

The inclined Gothic is the vertical Gothic inclined at about 15° from the perpendicular. We need not make any special analysis of the separate letters as that has been done for the vertical Gothic. This is a favorite alphabet for draughtsmen who do a great deal of lettering as it can be done with great speed and if carefully done it looks neat and is very legible. For these reasons it is especially valuable for large amounts of labeling.

The Roman Gothic is in many respects a more pleasing alphabet than the Gothic. The basis of the letters is the same as for the Gothic but certain lines called body strokes are shaded by being made thicker, while some lines are made thinner than in the Gothic letter. The shaded or body strokes are usually made one unit wide and the hair lines are usually made one-half unit wide. Roman Gothic letters of widely different appearances may readily be secured by varying the width of the hair line. It should be noted that the curved body strokes are slightly thicker than the straight body strokes. Where curved lines join straight lines the union is made very gradually so that the eye cannot detect the point of union.

The Roman letter is a further modification of the Roman-Gothic by the addition of serifs to the strokes so that no lines end with a line of uniform thickness. This is the type of letter used in most printing and is the most difficult letter for the draughtsman to handle. However, it is perhaps the neatest appearing letter and should be used more extensively than it is at the present time. The separate letters need not be analyzed separately because they have essentially the same form as in the Gothic alphabet. The body stroke is usually considered as one unit in width for the straight lines and slightly wider for the curved lines. Sometimes variation in this standard is made for some special purpose. The hair lines vary greatly in different styles of this letter from lines as thin as they can be drawn easily to lines at least half a unit in width. By varying the widths of the hair lines, letters of quite different appearances may easily be secured. The serifs demand special attention and must be drawn neatly and accurately or they will ruin the appearance of the lettering. Horizontal serifs are usually about one unit in length and are con-

nected to the main stroke by a gentle curve which is made tangent to the main stroke and to the serif. Vertical serifs are usually made about one and one-half units long and are connected to the main stroke by a gentle curve which is tangent to the serif but not tangent to the main stroke. Exception, however, must be made in the case of the double serifs found on the tongue of the E and F, which are smaller than the other vertical serifs. In letters like E, s and Z in which are two vertical serifs the upper one is made slightly shorter than the lower one for the sake of appearance. In the capital J and some of the lower case letters it will be noted that curved lines instead of ending in straight serifs end in curved comma shaped marks called kerns. Instead of filling in the body strokes of Roman letters solidly they may be indicated by two hair lines. This makes a neat appearing letter and is useful for display titles but is difficult to execute and therefore seldom employed in labeling biological illustrations.

EXPLANATION OF PLATES

Plate XIV. Letters and figures of various sized type.

Plate XV. Vertical Gothic letters analyzed.

Plate XVI. Roman Gothic letters analyzed.

Plate XVII. Roman letters analyzed.